



# ATCO NEWSLETTER

VOLUME 6 NUMBER 3

JULY 1989

## HAVE A NICE SUMMER!

After a dripping and sometimes chilly spring that has persisted through May and most of June, let's hope summer has really arrived by the time this reaches your mailbox. Have a nice summer, and we are planning on seeing each other before the October newsletter is published (see page 3).

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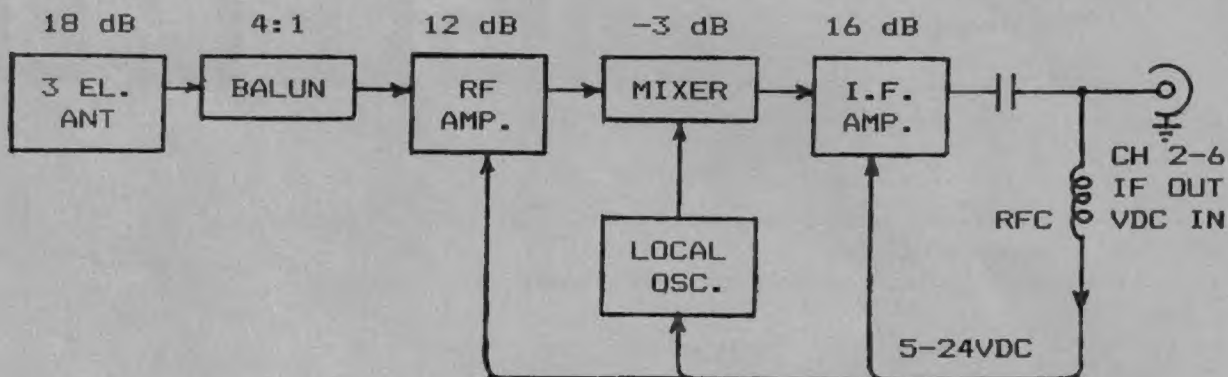
The ATCO Newsletter is the official publication of a group of television amateurs known as "AMATEUR TELEVISION IN CENTRAL OHIO" and is published in January, April, July, and October.

Membership in ATCO is open to any FCC licensed radio amateur who has an interest in amateur television.

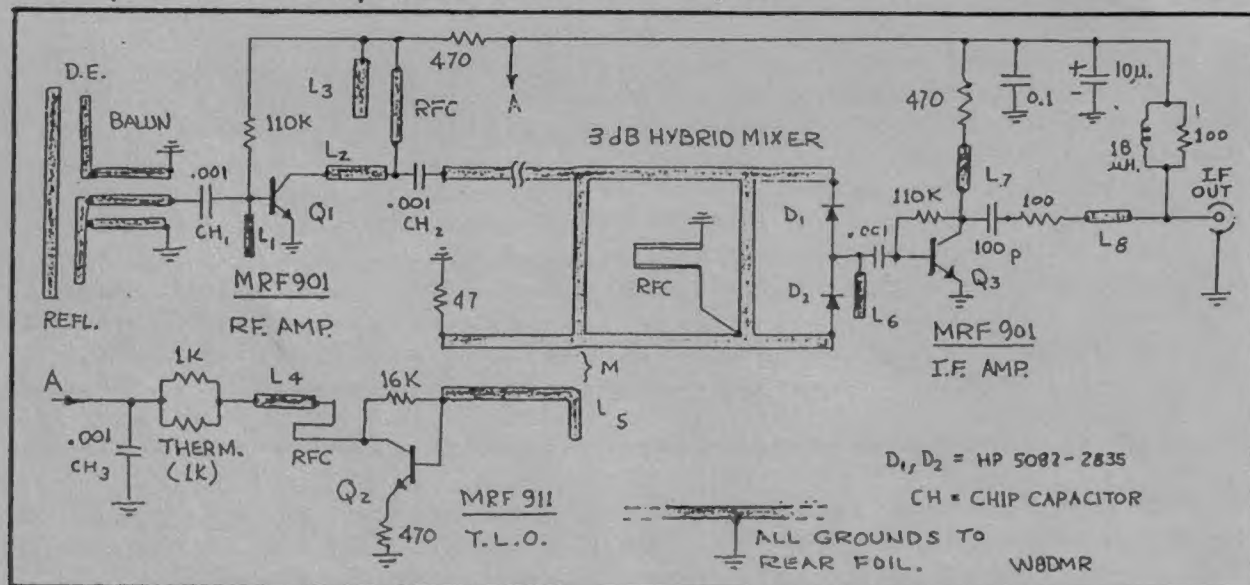
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### 13 CM ATV DOWNCONVERTER

A downconverter for 2.4 GHz is needed to receive the FM video signals from the microwave oven ATV transmitter described in the April 1989 ATCO Newsletter. The gain of the downconverter including the 20 inch parabolic dish is 40+ dB, and the downconverter is mounted in the dish antenna. The converter output is in the low VHF TV channel 2 through 6 range. Inexpensive RG-6 coaxial cable works satisfactorily for the down lead feed. The tuning voltage is from +5 to +24 VDC.



Gain distribution is shown in the block diagram above. The unit has a singly balanced hybrid mixer using hot-carrier diodes, and the local oscillator is temperature compensated for stability. An RF and IF amplifier are included in the downconverter probe. The antenna driven element, reflector, and quarter wave balun are also parts of the probe.



The downconverter kit may be purchased from K&S Electronics, P.O. Box 34522, Phoenix, Arizona 85067. Cost of the dish antenna is (continued on page 6)

## ATV NEWS ITEMS OF INTEREST

By Bill, W8DMR

1989 ATCO SOCIAL EVENT OF THE YEAR - Tom, K8ZNY, and Bill, W8BURI, are planning a Show 'n Tell event for our next ATCO get-together. A special mailing detailing the location, date, and time will be forthcoming.

AMATEUR TELEVISION QUARTERLY MAGAZINE (ATVQ) - Many ATCO members have received both the January and April 1989 ATVQ magazine free of charge from the publisher. ATVQ is a great ham ATV magazine with color photos and many articles of excellent quality. The three column format and the color picture centerfold in the April issue are superb.

ATV HAM TIES KNOT - ATCO congratulates Dale, W8KQQ, and his new bride.

MICROWAVE OVEN ATV TRANSMITTER UPDATE - W8DMR was privileged to meet Dave Pacholok and to view his program on the transmitter at the Dayton Hamvention. The color bar test pattern that was transmitted was very clean and colorful.

W8EOY TESTS FIRST CENTRAL OHIO MICROWAVE OVEN XMITTER - John has completed his version of the MOT in fine style and is still making minor improvements as well as gathering operational data. His progress has been outstanding.

W8RVH NOW ACTIVE ON 439, 910, AND 1270 MHz - Having recovered from antenna wind damage and the failure of a transformer in his high voltage power supply, Dick is again operational.

AMSAT NET ON 80 METERS - Perry, W8BOTH, reports that the AMSAT Net can be heard on 3840 kHz every Tuesday at 9 p.m.

W8BELK FLIES 50 mW ATV XMITTER WITH KITE - Using a kite with an eight foot spread and 1000 yards of line, Bill's kite reached a height of about 500 feet. The transmitter package weighed one pound, and Dick, W8RVH, saw sync bars. A video tape of the launch and flight shows several harrowing experiences.

33 cm TESTING CONTINUES - The following stations are currently active on 33 cm: K8HVA; W8KQQ; K8LWR; K8PYQ; W8RVH; W8VNC; and W8VSY.

AMANDA, OHIO, NOW ACTIVE ON 439.25 MHZ - Bill, KN8DMK, has just completed a modification to a commercial 450 amplifier and is transmitting P-5 signals with excellent video modulation.

W8BURI 23 cm TRANSMITTER PROJECT - After several setbacks, Bill is again making steady progress. He has located some low-loss coax cable and is not planning to mast-mount the power amplifier.

## MICROWAVE OVEN XMTR INFO

This is additional information regarding the transmitter described in the April 1989 ATCO Newsletter. The LF-357 is a typical low frequency op amp with FET inputs. It is not a video op amp. A video op amp must be used as a ECG-918M. A plain video amplifier (non-op amp) will not suffice. It should be a double (not single) supply, high speed, wide band video op amp.

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## WHAT IS A HOT-CARRIER DIODE?

A typical diode has a semiconductor junction formed by P-type and N-type material. A diode may also be formed by using a semiconductor and metal. Instead of a PN junction, it may be referred to as a N-M or P-M junction. Development of semiconductor-metal diodes lagged behind PN junctions because of difficulty in manufacturing. Silicon-metal diodes exhibit a voltage breakpoint of 0.2 volts, similar to germanium diodes. The metal selection determines the breakpoint.

The N-M junction diode current is the transport of electrons, hence is a majority-carrier current. Electrons which have crossed the junction into the metal are not distinguishable from the electrons which constitute the conduction electrons in metal. When the voltage across the junction is reversed, the electrons are no more able to return across the junction than are the electrons of the metal.

The reverse recovery time of a very fast PN junction may be as low as 0.7 nanoseconds (700 picosec). The recovery time of a semiconductor-metal diode is in the order of 50 picoseconds, an order of magnitude faster.

When a semiconductor-metal diode is forward-biased, the electrons in crossing the junction to enter the metal fall down a potential hill. Therefore, initially, until these electrons come to equilibrium with the electrons of the metal, the injected electrons have a higher energy and velocity.

The mean energy of the injected particles (molecules in a GAS, electrons in metal, etc.) is measured as a "temperature." Thus the injected electrons are referred to as "hot" electrons, and the N-M diode is referred to as a hot-carrier diode. Because electrons have the greater mobility, hot-electron diodes are preferred over hot-hole diodes. Hot-carrier diodes are used in mixer circuits and provide better performance at UHF/microwave frequencies and lower signal levels.

Type 1N34 and 1N82 are germanium signal diodes and are not hot-carrier diodes. For example, an HP 5082-2835 is a hot-carrier diode (HCD). The diode symbol used in schematic diagrams does not differentiate between signal and hot-carrier diodes. Downconverters using single-balanced or double-balanced hybrid ring mixers utilize hot-carrier diodes exclusively. (Submitted by Bill, WBDMR.)

## NEW ATCO NEWSLETTER FEATURE? MAYBE!

We are planning to print computer programs related to amateur radio submitted by you in each issue of the newsletter. Such programs serve several purposes: they are useful; they keep you from getting rusty in program entry; and they help you to learn how to write programs that are technical in nature by understanding how they work. Send your favorite ham programs to the editor so that our members can share it. To get us started, Bill, WBDMR, submitted the following SWR program:

```
10 REM      SIMPLIFIED SWR PROGRAM BY WBDMR
20 INPUT "FORWARD POWER (WATTS) : ",FP
30 PRINT
40 IF FP<=0 THEN 20
50 INPUT "REVERSE POWER (WATTS) : ",RP
60 PRINT
70 IF RP<0 THEN 50
80 IF RP>FP THEN 50
90 IF FP=RP THEN 180
100 RP=RP+1E-08
110 P=SQR(FP/RP)
120 SWR=(P+1)/(P-1)
130 SWR=INT(SWR*10+.5)/10
140 PRINT "STANDING WAVE RATIO      :";SWR;"TO 1."
150 PRINT
160 PRINT
170 GOTO 20
180 PRINT "STANDING WAVE RATIO      : INFINITY !"
190 GOTO 150
200 REM CHECK: IF FORWARD = 10 & REVERSE = 2.5
210 REM      THEN,  SWR = 3 TO 1
```

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### LETTER TO THE EDITOR

An eyeball QSO in the OR? Yes. While lying on the operating table in the operating room at Riverside Methodist Hospital being prepared for minor surgery, I had the unique experience of an eyeball QSO with Tom, W8TK. He was the anesthesiologist who held my hand during eyelid surgery. Three days later, I received Tom's QSL card. Would anyone care to speculate what the odds were that this QSO would happen?

Chick, W8RZG

Chick, are you sure you didn't call CQ?

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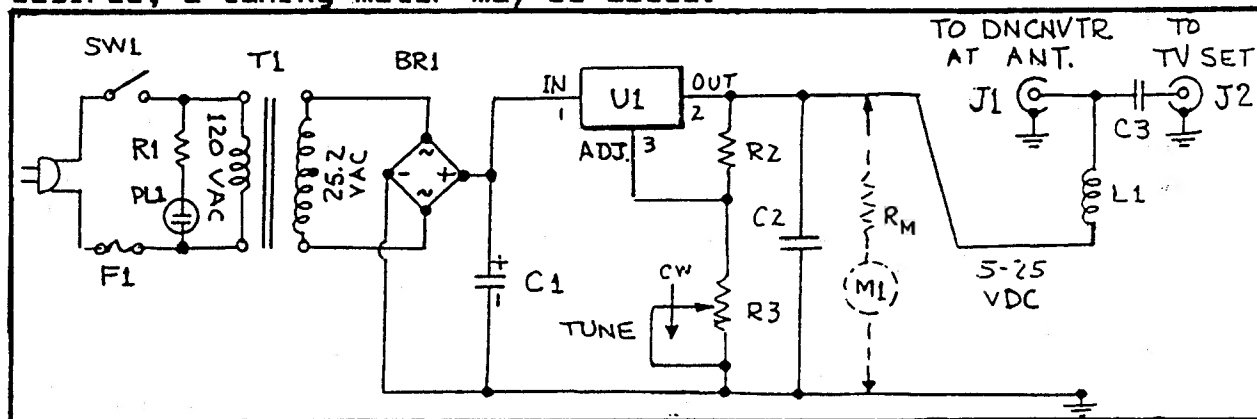
## 13 CM ATV DOWNCONVERTER

(continued from page 2)

\$23.00 including shipping; the downconverter sells for \$27.50 including shipping and contains the probe housing, electronic parts, PC board, connector, layouts, and assembly information. The block diagram and schematic are NOT included.

### DOWNCONVERTER POWER SUPPLY

A downconverter power supply schematic is included in this article, and the power supply may be fabricated from readily available parts and customized to meet your particular needs. This power supply provides a variable voltage from +5 to +25 volts for the antenna mounted 2.4 GHz downconverter. The voltage tunes the converter from approximately 1.9 to 2.7 GHz. The +5 lower voltage is the lower frequency, and the +25 higher voltage is the higher frequency. Clockwise (CW) rotation of the potentiometer tunes the downconverter to a higher frequency. If desired, a tuning meter may be added.



POWER SUPPLY SCHEMATIC

### DOWNCONVERTER POWER SUPPLY PARTS LIST

Item	Description	RS Part No.	Cost
BR1	Bridge, 1.0 amp, 50 PIV	276-1161	\$ .89
C1	Capacitor, 1000 uF, 35 V	272-1019	1.59
C2	Capacitor, .047 uF, 50 V	272-0134	.49
C3	Capacitor, .001 uF, 500 V	272-0126	.49
CD1	Cord, 18 gauge, 125 VAC	278-1255	.99
F1	Fuse, 0.5 amp, 125 VAC	270-1271	.79
FH	Fuse holder, 125 VAC	270-0364	1.29
J1,J2	Connector, F-61, chassis mnt.	278-0212	.99
L1	RF Choke, 100 uHy	273-0102	.99
M1	Meter, 0-1 Ma., Rm added	Your Choice	
PL1	Pilot lamp, red, 125 VAC	272-0712	1.99
R1	Resistor, 68 k ohms, 1/2 W.	271-0011	.19

(continued on page 7)

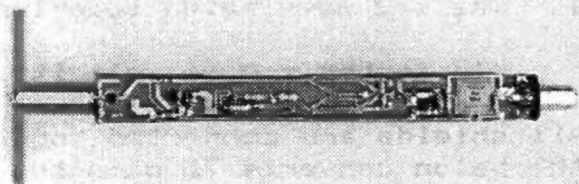
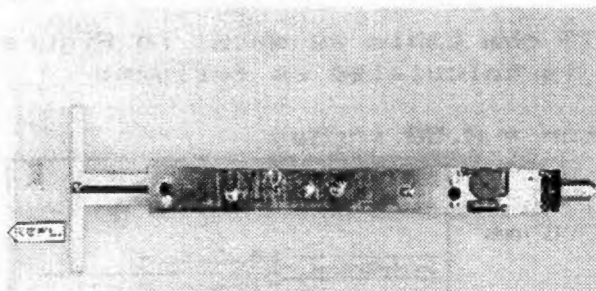


# 13 CM ATV DOWNCONVERTER

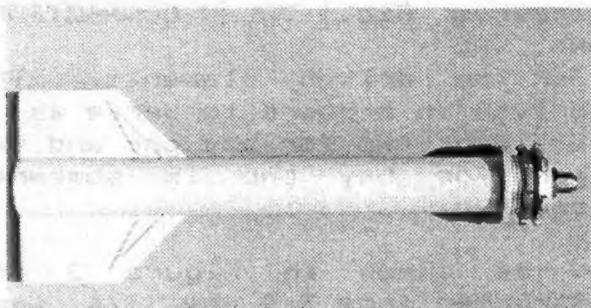
(continued from page 6)

Item	Description	RS Part No.	Cost
R2	Resistor, 150 ohms, 1/2 W.	271-0013	.19
R3	Resistor, 10 k ohms, pot.	271-1715	1.09
SW1	Switch, SPST, 3 amps, 125 VAC	275-0645	1.99
T1	Transformer, 25.2 VCT	273-1386	4.59
U1	IC, LM-317-T, adj. reg.	276-1778	1.99

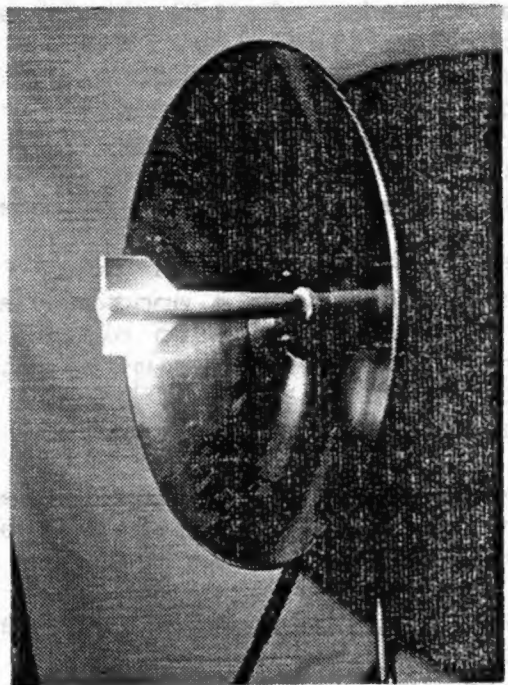
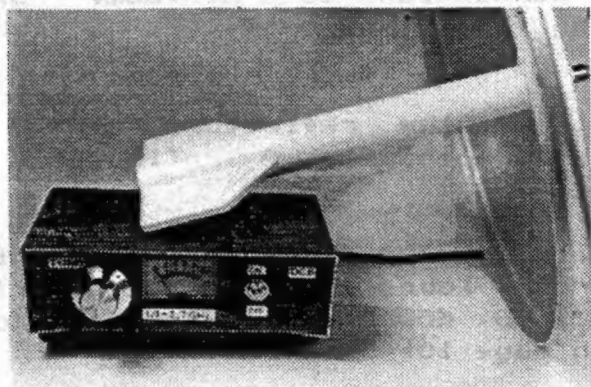
A few of the bubble package part numbers contain a quantity of more than one item. The do-it-yourself cost of the downconverter power supply is about one-half the cost of the commercially manufactured unit. The assembled power supply may be purchased from K&S Electronics, also. Cost is \$37.50 which includes shipping charges. A schematic is not available with the purchased supply. (Submitted by Bill, W8DMR.)



ANTENNA AND DOWNCONVERTER ASSEMBLY



ANTENNA AND DOWNCONVERTER ASSEMBLY



DISH ANTENNA

## FRANKLIN COLLINEAR ARRAY

The collinear antenna array described in this article is a Franklin type of an array with reflectors spaced behind each element. There are 36 driven elements and 36 reflectors for a total of 72 active elements. For 70 cm, the driven elements are 13 inches in length, and the reflector elements are 5 percent longer or 13-5/8 inches. The phasing stubs are 13 inches in total length, and the stacking distance between bays is 13 inches. A noncritical spacing between driven elements and reflectors is 5-1/2 inches or approximately 0.2 wavelength.

The feed point impedance of the array is in the range of 300 ohms, and a good grade of 300 ohm twin lead matches well. At the transmitter end, a coaxial cable balun is used to transform the impedance from 300 to 50/75 ohms for connection to the transmitter and/or receiver.

The balun is constructed of RG-59 75 ohm cable as shown in Figure 1. The 1/2 wave balun loop length is calculated as follows:

$$13 \text{ inches} \times 0.66 \text{ velocity factor} = 8.58 \text{ inches}$$

All shields are connected together, and the balun converts 75 ohms to 300 ohms (a 4 to 1 impedance change).

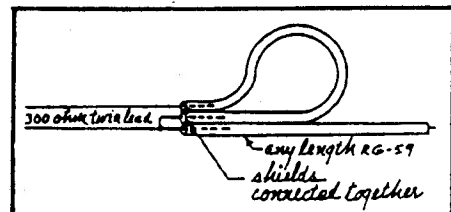


Fig.1-BALUN CONNECTION

Figure 2 depicts the overall array concept. The elements and phasing stubs are made of 1/8 inch soft aluminum clothes line wire. Figure 3 shows the details of the bending procedure for the driven elements. The dots indicate where nails can be driven in a board to serve as a template for bending. Four are required: two for bay one and two for bay three. The configuration for bay two is somewhat different. Two are required for bay two.

The formed elements are fastened as shown in Figure 2 and assembled onto a wooden frame constructed from 3/4 by 3/4 inch redwood designed to minimize weight. The folding of the elements reduces the number of electrical connections to a minimum. Use of the nail template makes bending easy and provides uniform element sections.

No connection is made between all of the reflectors and the driven elements; each reflector is independent. A reflector is mounted behind each driven element.

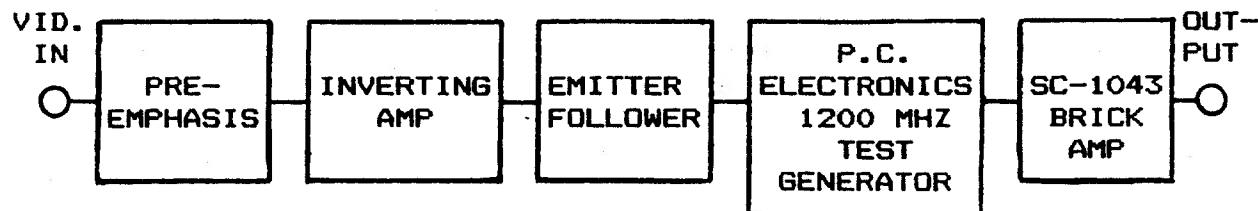
The array has about 18.5 dB of gain as compared to a single dipole. The antenna exhibits a front lobe width of about 15 degrees with two side lobes of 12 dB down. The front-to-back

(continued on page 10)



# 1200 MHz FM ATV TRANSMITTER

For those readers wishing to build this transmitter, complete construction details are available from W8BURI and W8DMR.



BLOCK DIAGRAM

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## TELEVISION CHANNEL FREQUENCIES

VHF Channels 2-13 • UHF Channels 14-69

Bandwidth per channel, 6 megacycles.

Picture carrier frequency is 1.25 megacycles above the low frequency edge of the band.

Sound carrier frequency is 0.25 megacycles below the high frequency edge of the band, and 4.5 megacycles above the picture carrier frequency.

Channel	Frequency Limits (MHz)	Video Carrier (MHz)	Audio Carrier (MHz)	Channel	Frequency Limits (MHz)	Video Carrier (MHz)	Audio Carrier (MHz)
1		(Not assigned)		36	602-608	603.25	607.75
2	54-60	55.25	59.75	37	608-614	609.25	613.75
3	60-66	61.25	65.75	38	614-620	615.25	619.75
4	66-72	67.25	71.75	39	620-626	621.25	625.75
5	76-82	77.25	81.75	40	626-632	627.25	631.75
6	82-88	83.25	87.75	41	632-638	633.25	637.75
7	174-180	175.25	179.75	42	638-644	639.25	643.75
8	180-186	181.25	185.75	43	644-650	645.25	649.75
9	186-192	187.25	191.75	44	650-656	651.25	655.75
10	192-198	193.25	197.75	45	656-662	657.25	661.75
11	198-204	199.25	203.75	46	662-668	663.25	667.75
12	204-210	205.25	209.75	47	668-674	669.25	673.75
13	210-216	211.25	215.75	48	674-680	675.25	679.75
14	470-475	471.25	475.75	49	680-686	681.25	685.75
15	476-482	477.25	481.75	50	686-692	687.25	691.75
16	482-488	483.25	487.75	51	692-698	693.25	697.75
17	488-494	489.25	493.75	52	698-704	699.25	703.75
18	494-500	495.25	499.75	53	704-710	705.25	709.75
19	500-506	501.25	505.75	54	710-716	711.25	715.75
20	506-512	507.25	511.75	55	716-722	717.25	721.75
21	512-518	513.25	517.75	56	722-728	723.25	727.75
22	518-524	519.25	523.75	57	728-734	729.25	733.75
23	524-530	525.25	529.75	58	734-740	735.25	739.75
24	530-536	531.25	535.75	59	740-746	741.25	745.75
25	536-542	537.25	541.75	60	746-752	747.25	751.75
26	542-548	543.25	547.75	61	752-758	753.25	757.75
27	548-554	549.25	553.75	62	758-764	759.25	763.75
28	554-560	555.25	559.75	63	764-770	765.25	769.75
29	560-566	561.25	565.75	64	770-776	771.25	775.75
30	566-572	567.25	571.75	65	776-782	777.25	781.75
31	572-578	573.25	577.75	66	782-788	783.25	787.75
32	578-584	579.25	583.75	67	788-794	789.25	793.75
33	584-590	585.25	589.75	68	794-800	795.25	799.75
34	590-596	591.25	595.75	69	800-806	801.25	805.75
35	596-602	597.25	601.75				

# FRANKLIN COLLINEAR ARRAY

(continued from page 8)

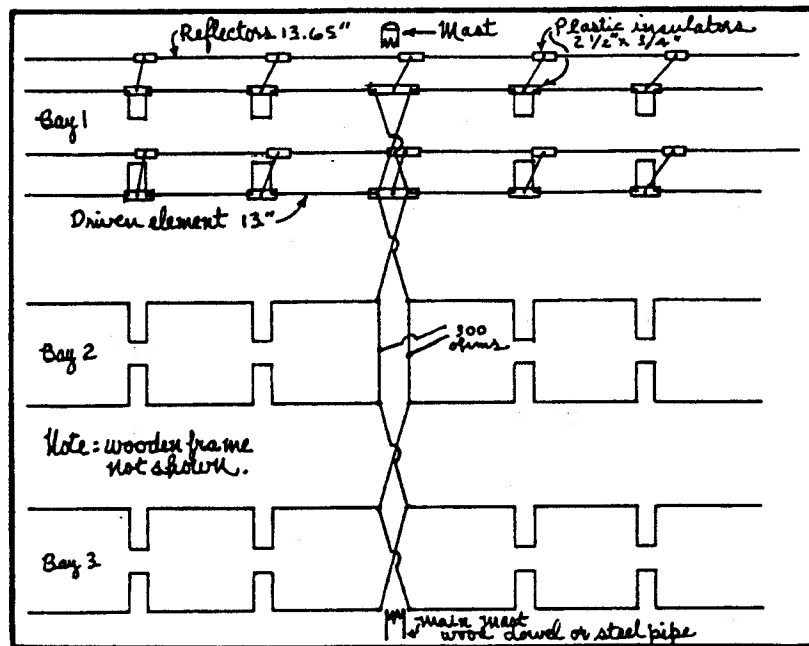


Fig.2-ANTENNA ARRAY

(see Figure 4). The Franklin design has been scaled (and adjusted and tested) for the 33 cm and 23 cm (910 and 1258 MHz) bands with equally good results. (Submitted by Dick, WBRVH.)

ratio is only about 8 dB and considered not very good. However, this is an advantage when the direction of the incoming signal is not known. One disadvantage of the 72 element array is wind resistance which depends on just how the antenna is stowed with respect to wind direction.

A final correction of SWR can be made by sliding a two inch piece of aluminum foil up-and-down the insulated twinlead at the transmitter end

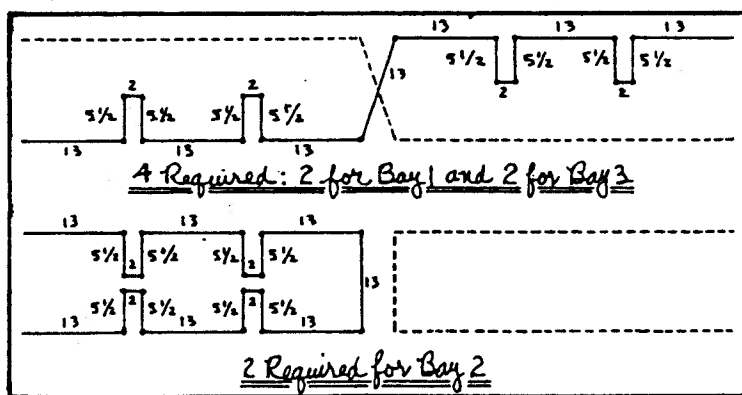


Fig.3-BENDING LAYOUT

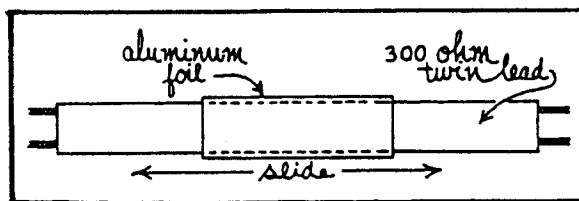


Fig.4-SWR CORRECTION

## ATCO NET CONTROL OPERATORS

Here's a listing of ATCO members who have volunteered as ATCO Tuesday Night Net Control Operators. Each operator will take the net in the following order (alphabetically by call sign prefix then in alphabetic order by call suffix):

1. Warren, KABGZQ
2. Dave, WBAER
3. Bill, WBDMR
4. John, WABEY
5. Ken, WABRUT
6. Phil, WABTTE
7. Bill, WBBURI
8. Tom, WD8QBT

John, WABEY, is our ATCO Tuesday Night Net Coordinator.

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## UNION COUNTY ARC GETS NEW TOWER

The Union County Amateur Radio Club recently replaced its 100 foot American tower with a new 120 foot Rohn 25G tower. After antennas and feedlines were installed, Gene, WBBJN, transmitted video from his ATV antenna located at the tower's 90 foot level. Gene has a video tape of the removal of the old tower and its replacement which he will televise upon request. The Marysville repeater transmitting antenna is located on the new tower. Gene recently joined ATCO and invites all ATVers to use the repeater at any time. The repeater has a receiver at 555 feet on the LeVeque tower in Columbus and receivers in Delaware, Marysville, and Dover; the operating frequency is 147.99/39 MHz.

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## MARYSVILLE HAMFEST 27 AUGUST

This year's Marysville Hamfest will take place on Sunday 27 August at the Union County Fairgrounds. The flea market will open for business on Saturday 26 August at noon, and on Saturday evening the famous "Ham-Band" composed of local amateurs will play from 8 to 11 p.m. The band features Dan Rice, world renowned harmonica great. There is no charge for this part of the program. Also, free overnight camping with good facilities is available, and food can be purchased on Saturday and Sunday.

On Sunday, the flea market will open at 6 a.m. with lots of door prizes awarded every hour, several computer and ATV displays, and satellite video sales. Hamfest tickets are \$3 in advance or \$4 at the gate. Flea market spaces are \$1 per 10 feet of space. Tickets are available at Universal Amateur Radio or by mail. For more information, contact Gene, WBBJN, 13613 US 36, Marysville, Ohio 43030, phone: 513-644-0468.

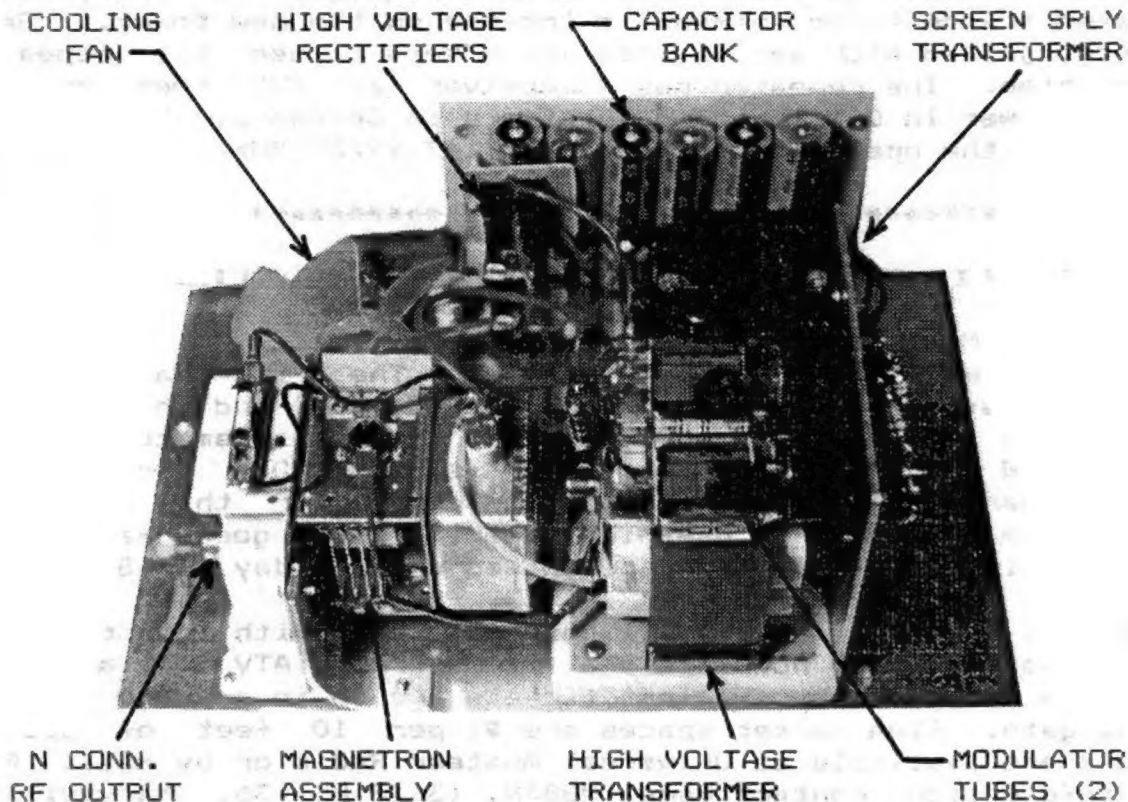
## MICROWAVE OVEN XMTR DATA

John, W8E0Y, has nearly completed his microwave transmitter and has been conducting tests to verify operation. The readings tabulated below were forwarded to us by John for your review and future reference.

SPLY VOLT	MAG VOLT	MAG MILS	MOD VOLT	MOD WATT	MAG WATT
5520	0	0	0	0	0
4452	3414	50	1038	52	172
4320	3484	100	836	83	348
3938	3448	150	490	74	517
3756	3654	175	102	18	639

NOTE: Readings taken without video modulation.

Pictured on this page is W8E0Y's transmitter which is an example of homebrew ATV construction techniques. Photo was taken by W8DMR.



W8E0Y'S 13 CM MICROWAVE OVEN TRANSMITTER

## ATCO FINANCIAL STATEMENT

CASH BALANCE:  
As of 31 March 1989.....\$473.50

RECEIPTS:  
Dues.....\$ 70.00

EXPENDITURES:  
Printing charges for April 1989 ATCO Newsletter.....\$ 35.45  
Postage for April 1989 ATCO Newsletter..... 15.30  
Misc. costs incidental to publication of newsletter.. 17.67  
Total expenditures.....\$ 68.42

SUMMARY:  
Cash Balance as of 31 March 1989.....\$473.50  
Receipts..... 70.00  
Expenditures..... -68.42  
Balance as of 30 June 1989.....\$475.08

The above financial report was prepared as of 30 June 1989 by  
Warren G. Duemmel, K8GZQ, Acting ATCO Treasurer.

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## ATCO ROSTER CHANGES

Please refer to the list of ATCO members appearing on page 12 of  
the ATCO Newsletter for April 1989.

Add:  
W9AZO Jim Walter, 2662 St. Rt. 39 NW RD#3, Mansfield 44903  
W8BBW Joe Schumann, 5418 Marietta Road, Chillicothe 45601  
W8BJN Gene Kirby, 13613 U.S. 36, Marysville 43040  
W8BELK Bill Brown, 12536 T.R. 77, Findlay 45840  
W8GI Chris Vojsak, 2050 Ellington Road, Columbus 43221  
K8ISM Steve Iacono, 1075 Virginia Avenue, Columbus 43212  
K8BPN James Easley, 1507 Michigan Avenue, Columbus 43201

Change:  
W8BWEX should read K8BWEX.

\*\*\*\*\*  
**NEW ATCO MEMBERS**

We welcome the following:

Jim, W9AZO; Gene, W8BJN; and Jim, K8BPN.

\*\*\*\*\*  
**DAILY HDTV BROADCASTS**

As this issue of the ATCO Newsletter goes to press, some "lucky"  
Japanese TV viewers will be watching high-definition television.  
According to a New York Times news item, the initial  
transmissions will be only one hour each day, and almost no one  
will be seeing the video. The article states that the Japanese  
have a head start in the development of HDTV; their government  
believes this will be a \$25 billion industry by the year 2000.  
Although there are American companies gearing up for HDTV, Tokyo  
electronic executives say our efforts are too late and too small.  
The cost of a HDTV monitor remains at \$60,000.

Editor: Warren, KA8GZQ  
Technical Editor: Bill, W8DMR

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FIRST CLASS MAIL

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ATCO NEWSLETTER  
c/o Warren G. Duemmel  
3488 Darbyshire Drive  
Hilliard, Ohio 43026

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## ATCO NEWSLETTER

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### CONTRIBUTORS TO THIS ISSUE

Thanks to the following ATCO members for submitting material for publication in the July 1989 newsletter:

Gene, W8BJN: information about the Union County ARC's new tower, Marysville Hamfest, and television channel frequencies.

Bill, W8DMR: "13 cm ATV Downconverter," "ATV News Items of Interest," and "What is a Hot-Carrier Diode?"

Dick, W8RVH: "Franklin Collinear Array."

John, W8E0Y: "Microwave Oven Xmtr Data."